

# **UNHINGED**

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## Abstract

This document identifies the requirements, constraints, metrics, and specifications needed to design the jig for the hinges that Ambico requested us to do. We did some research to help us find similar products and determine the materials to use. All of this information is important in determining the overall process for this project.

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## Prioritized Design Criteria

### *Functional requirements:*

1. **Make accurate holes as fast as possible(min):** the main reason they are looking to change what they are doing right now is so they can save time and money. This means that if the device takes more time, they will not accept it.
2. **Can be attached to the door:** It is also important for the device to have the capability to be attached and removed from the door. The worker needs his two hands to be free to hold the drill properly. Moreover, the device needs to be easily attached without taking much time.
3. **Can be used for multiple hinge sizes:** the client uses two different hinges for their doors, which means that we should account for that by either making two separate devices or making an adjustable one.
4. **Can be operated in a dusty environment:** the workshop is a dusty environment as all the manufacturing is done there. This means that the device cannot have a lot of complicated or small parts that can easily jam. So, it is preferable to have a device with as few moving parts as possible and to be easy to clean.

### *Non-functional requirements:*

1. **Long life compared to the price(years):** the product should have a long life relative to its price. The reason for this is that they want to save on resources.
2. **Easy to use:** this product should be simple and easy to use. We don't know how much time they set aside to train their staff on everything, so the product should be easily accessible to any worker.
3. **Friction resistant:** the device will have a drill passing through it on a daily basis. That's a lot of friction that can corrode a lot of materials; so we should get a very sturdy material or protect the product in some other way.
4. **Drill guide:** as per the client's demand, they would prefer if the device had the capability to keep the drill perpendicular to ensure that the holes are straight.

### *Constraints:*

1. **Time<30 min:** the client already takes 30 minutes to do the job, so the device should make it take less time.
2. **Cost < \$100:** the client has an allotted budget of \$100, so the device's price should be at a max of \$100.
3. **Size small to fit the door:** the device should be small enough to fit the door.

### *Metrics:*

1. Weight (300-700) grams
2. Size (5" length x 4.5" width, with 3 different backsets of 9/16", 1/4" and 1.1/16"; 4.5" length x 4.5" width and has a backset of 1/4"

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## Technical benchmarking

After meeting with the customer, it was realized that there were only two hinges: they use 5" long x 4.5" wide, with 3 different backsets; 9/16", 1/4" and 1.1/16". The second hinge size the customer uses is 4.5" long x 4.5" wide and has a 1/4" backset. The customer also mentioned that he already had a milling jig to help him set the hinge. The way the customer prepares the door for the hinges is to mark the position of the holes by hand, place the hinge and drill the holes, making sure the holes are straight, which requires both hands. Once all the holes are drilled, a tapping machine is used to create rivets in the holes so that the screws can be fastened and ensure that the hinges are secure when fastened.

At the meeting, customers pointed out that what they need is to speed up production: the more doors that are prepared for hinges, the more they can ship and the more money they will make. Helping production would be speeding up the marking, drilling and tapping part of hinge preparation. That's what we were looking for when we researched the door hinge jigs that are on the market right now.

After researching what type of door hinge jigs are on the market, we found a few different types of jigs. We have included a few shown in Figure 1, Figure 2 and Figure 3.

Most of the inline jigs are for routing the holes in which the hinges are placed, as well as in Figure 1, where it is a jig for the pass-through latch and the hole in the door frame to lock the door. This was not necessary, as they have a jig for this. The second important jig for hinges that we found on the market was that it helped with the spacing of the hinges on the edge of the door, as in Figure 3, this is not a customer need, considering that the doors are custom made and different from one to another. We then came up with a jig that was more suited to the customer's needs, as in figure 2 where the hinge is attached to a bar and then can be clamped to the edge of the door and marked, drilled and tapped; the problem is that you have to hold the jig with one hand to mark and then lower it to drill. This does not meet the customer's needs as it does not speed up the marking, drilling and tapping part of preparing the door for the hinge. In our research we have found that there is nothing that meets the customer's needs to speed up production. Knowing the customer's needs and what is on the market allows us to create the best jig for the customer and meet their needs.

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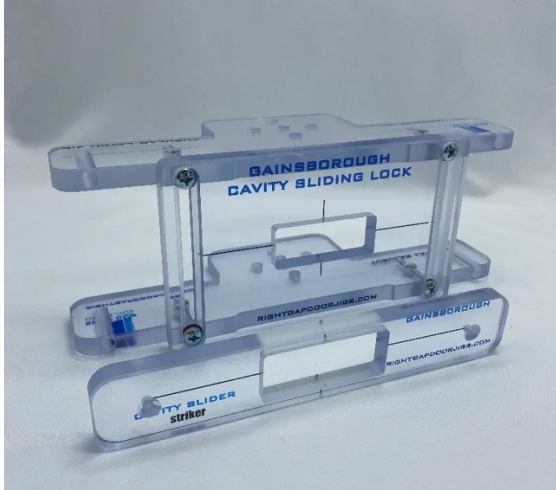


Figure 1

Jig for the pass-through latch and the hole in the door frame to lock the door. Price \$450



Figure 2

Hinge is attached to a bar and then can be clamped to the edge of the door and marked, drilled, and tapped. Price \$570



Figure 3

Helps with the spacing of the hinges on the edge of the door. Price \$355

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## Target Specification

According to the client requirements, we have determined the model attribute tentatively. Here's the CAD model of the product prototype. It is an ideal prototype.

<https://cad.onshape.com/documents/46d4f335205ea4e09ceb75c3/w/8536e6e97feb14f19cd9eaf4/e/b9e0022de137555f8fa3fc2f?renderMode=0&uiState=651f38f87187d9394f09706f>

The selfie stick-like structure is able to let the worker fix the jig easily. Details about the numerical value and range information are all in the CAD model. The data is temporary, it could be changed based on the updates of group discussion and the client meeting, etc.

## Reflection

The client meeting was very informative and beneficial to the design of our door hinge jig. Before the meeting, we thought we just needed to make a simple jig of the hinges that fit the parameters of being 5" length x 4.5" width, with 3 different backsets: 9/16", 1/4" and 1.1/16". The second size of hinge that the client uses is 4.5" length x 4.5" width and has a backset of 1/4". After the meeting it was understood that yes, we need to make that, but also that they are marking drilling and tapping the holes for the hinges as well. The client meeting also informed us that those tasks are what will take the longest to complete and this is where they would like to speed things up. Knowing this we were able to design our jig to ensure maximum efficiency for said tasks. The needs in Deliverable B didn't need to be changed as we are still ensuring the productivity of the doors still to be as quick as possible. After the next client meeting our trajectory and product design could change but as of now, we are trying to meet exactly what our client has mentioned in the meeting.



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## References

- **Figure 1:** <https://rightgapdoorjigs.com/product/residential-hinge-and-latch-combo/>
- **Figure 2:** <https://www.amazon.ca/Trend-JIG-8FT-Hinge-Piece/dp/B00CSSY5QC?th=1>
- **Figure 3:** <https://www.rutlands.com/products/phenolic-hinge-jig-for-standard-fire-doors>